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THE PINNIPED POPULATION OF  
AÑO NUEVO ISLAND, CALIFORNIA

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**ABSTRACT:** A 3-year study on Año Nuevo Island, California, showed that this area was regularly used by four species of pinnipeds, the Steller sea lion (*Eumetopias jubata*), the California sea lion (*Zalophus californianus*), the northern elephant seal (*Mirounga angustirostris*), and the harbor seal (*Phoca vitulina*). Steller sea lions were found there throughout the year although a minimum population, consisting of several hundred cows and young, occurred in late winter and early spring. In late April the first large males arrived. Maximum numbers of about 100 bulls were present by the end of May. Bachelors also began arriving in late April and reached maximum numbers by late June. There was a great increase in the number of females in late May and early June as the harems formed. By the end of June the female population was about 1,100. An estimated 1,000 pups were born in June and early July. The bulls and bachelors began to leave in the latter part of July at which time the harems broke up. They were essentially all gone by late August or early September. In midwinter another exodus of many of the females and young occurred.

Male California sea lions were present in numbers except from early June to late July when the species was essentially absent from the island. No females were noted here. Approximately 80% of the males present were adults. There were two population peaks, one in mid-May and the other around September 1. The latter peak was the higher and was found to double each year.

Elephant seals were present throughout the year; breeding occurred from late December to early March. Greatest numbers were noted in early May and during

October and early November. The spring peak was the higher of the two. Total numbers recorded on May 7, 1961, May 15, 1962, May 8, 1963, and May 7, 1964 were 86, 157, 450, and 483, respectively. These figures indicated a marked annual increase in numbers. Bulls were present only in midwinter and midsummer. In spring and autumn the population consisted almost entirely of immature animals. There was a resident population of about 100 harbor seals in the vicinity of Año Nuevo Island.

#### INTRODUCTION

In May, 1961, we began a study of the pinniped population on Año Nuevo Island which is one-half mile off the central California coast approximately 40 miles south of San Francisco. It was originally anticipated that observations would be concerned almost exclusively with the Steller sea lion (*Eumetopias jubata*) since the island has long been known to have one of the largest rookeries of these animals south of Alaska. However, it was soon discovered that it was also used regularly by three other species of pinnipeds, the California sea lion (*Zalophus californianus*), the elephant seal (*Mirounga angustirostris*), and the harbor seal (*Phoca vitulina*). A fifth species, the northern fur seal (*Callorhinus ursinus*), was also recorded here.

Between May 25, 1961, and May 7, 1964, 60 visits were made to the island primarily for the purpose of observing seasonal changes in its pinniped population and composition as well as to conduct behavioral studies on the several species concerned. There were a few occasions, however, when unfavorable conditions or disturbances made it impossible to secure accurate counts. Additional trips were made for other purposes at which times incidental population data were occasionally secured. All crossings of the half-mile channel separating Año Nuevo Island from the adjacent mainland were made in a 14-foot fiberglass boat with an outboard motor. As the result of unfavorable weather for considerable periods of time between October until April more days were spent on the island in summer than in winter (tables 1 to 3).

Counts were made with the aid of binoculars and were usually checked later against extensive photographs which were made on each visit. On-the-spot counts were frequently made from the top of the lighthouse which affords a view of most of the areas occupied by pinnipeds as well as by careful approach to each of the rookery or hauling-out areas. Effort was made to determine the sex and age composition for each species whenever possible.

#### HISTORY OF THE SEA LIONS IN CENTRAL CALIFORNIA

For the past century the specific composition of the sea lion population along the central California coast has presented many confusing aspects. This is an area where the ranges of two genera, *Zalophus* and *Eumetopias*, overlap. The breeding range of the northern Steller sea lion (*Eumetopias jubata*) extends from Japan northward to the Bering Sea, then down the coast of North America

TABLE 1. *Total Steller sea lion population on Año Nuevo Island from May, 1961, to May, 1964.*

Date	Number	Date	Number
1961		1963	
May 25	1,500	April 13	268
June 27	1,934	April 19	286
July 13	1,586	April 21	305
July 28	1,596	April 22	300
August 11	1,632	April 25	315
September 7	1,395	April 29	524
September 23	1,712	May 8	350
1962		May 23	672
February 24	225	May 27	418
March 24	451	May 29	428
May 15	193	June 4	1,045
June 5	839	June 6	954
July 3	1,822	June 11	1,166
July 16	2,226	July 12	2,395
August 4	1,255	July 23	1,981
August 18	2,629	July 30	2,625
September 1	2,207	August 19	1,605
September 21	2,009	August 23	1,509
October 24	1,188	August 30	1,510
November 26	940	September 6	1,070
December 20	1,543	September 13	1,186
December 29	1,220	September 27	1,602
1963		October 12	1,449
January 9	927	October 25	1,140
January 19	690	November 13	1,093
February 15	624	December 28	815
February 16	603	1964	
February 17	583	January 8	445
March 2	212	March 30	244
March 3	240	May 7	477

from Alaska to the Channel Islands off southern California (Scheffer, 1958). The California sea lion, *Zalophus californianus*, is represented by three separate breeding populations: *Z. c. wolfebaeki* in the Galapagos Islands, *Z. c. japonicus* in the Sea of Japan, and *Z. c. californianus* extending from the west coast of northern Mexico northward to the Channel Islands off southern California. The

distribution of *Eumetopias* and *Zalophus* outside of the breeding season, plus periodic decimation of large numbers of these animals by man in the past, has been responsible for much of the confusion apparent in the literature.

Rowley (1929) refers to some of the presumed errors and inconsistencies of early observers like Scammon (1874) and H. W. Elliott (1875). As Rowley points out, Captain Scammon's measurements and descriptions obviously indicate that he confused *Eumetopias* and *Zalophus* in the area where the two species overlap. Elliott (*sup. cit.*) reported both *Eumetopias* and *Zalophus* around San Francisco and the Farallon Islands, 25 miles to the west, yet indicated that in numbers *Zalophus* greatly predominated. Rowley implied that these early observers were in error and that *Zalophus* regularly came only as far north as Monterey. Bonnot (1928), however, who was also an authority on this group, stated that "In the past, the California sea lion was fairly abundant and probably maintained rookeries as far north as the Farallons. They have been recorded as far north as Puget Sound."

Sea lions of both species periodically were hunted and killed for their oil and hides from around 1860 until the early part of the present century (Rowley, *op. cit.*; Bonnot, 1951). This resulted in the elimination of certain breeding rookeries, including that at Seal Rocks, San Francisco, where Steller sea lions formerly bred, and a general reduction in the total number of sea lions of both kinds along the coast of California and Baja California. It also makes it difficult to ascertain the distribution and relative numbers of the two species of sea lions in this region prior to their disturbance by man.

In 1927 the California Department of Fish and Game, at the instigation of fishermen who believed that pinnipeds were increasing and endangering commercial interest, made a census of the sea lions along the coast between the Mexican border and the Oregon state line. This and subsequent censuses in 1928, 1930, 1936, 1938, 1946, and 1947 were conducted primarily by the late Paul Bonnot (Bonnot, 1928a, 1928b, 1931, 1937; Bonnot, Clark, and Hatton, 1938; Bonnot and Ripley, 1948). The results of these censuses are summarized in the last-cited publication. These counts were made in June or July, the breeding season for both species concerned. Pups, in most instances were not included. The northernmost point any California sea lions were noted was Pt. Reyes where nine were seen in 1936. Proceeding geographically southward, 6 were seen on the Farallon Islands in 1927, 28 in 1930, 25 in 1936, and 90 in 1938. None was noted during these years at Purissima Rock which is several miles south of Half Moon Bay. In 1936, 200 were counted on Año Nuevo Island. This was the first time this species was recorded here. No observations were made between Año Nuevo Island and the Monterey County coast because of the lack of either suitable hauling-out areas or rookeries.

The Steller sea lion counts over these areas at the same time were much greater, especially since Año Nuevo constitutes what is believed to be one of the



TABLE 2. *California sea lion population on Año Nuevo Island from May, 1961, to May, 1964.*

Date	Number	Date	Number
1961		1963	
May 25	1,500	March 3	186
June 27	1	April 13	1,289
July 13	5	April 19	1,254
July 28	319	April 21	1,146
August 11	1,700	April 22	1,966
September 7	3,243	April 25	1,488
September 23	1,827	April 29	1,345
1962		May 8	2,000
February 24	95	May 23	1,183
March 24	1,050	May 27	1,258
May 15	2,400	May 29	1,090
June 5	800	June 4	482
July 3	2	June 6	309
July 16	10	June 11	185
July 25	400	July 12	15
July 30	2,000	July 23	198
August 4	2,205	July 30	3,203
August 18	3,555	August 3	4,650
September 1	6,597	August 19	10,275
September 21	3,914	August 23	5,874
October 24	2,350	August 30	13,367
November 26	2,763	September 13	8,173
December 20	3,360	September 27	8,119
December 29	3,253	October 12	4,000
1963		October 25	5,251
January 9	818	November 13	6,285
January 19	1,102	December 28	2,899
February 15	503	1964	
February 16	298	January 8	250
February 17	232	March 30	915
March 2	417	May 7	3,428

largest breeding rookeries for this species south of Alaska. At Pt. Reyes 45 Steller sea lions were counted in 1936, 6 in 1938, and 2 in 1947. On Farallon Islands the number was 700 in 1927, 540 in 1928, 900 in 1930, 500 in 1936, 357 in 1938, and 750 in 1947. At Purissima the count was 150 in 1927, 42 in 1928, 4 in 1936,

2 in 1938, and 50 in 1947. The population on Año Nuevo was 1,500 in 1927, 1,500 in 1928, 2,500 in 1930, 1,000 in 1936, 2,000 in 1938, and 2,050 in 1947.

A census was taken along the California coast in 1958 and again in 1960 and 1961 by the Department of Fish and Game (Ripley, Cox, and Baxter, 1962). Pups were included in these censuses but no segregation was made as to species. During these 3 years aerial counts showed the Año Nuevo population to be 1,170, 1,350, and 2,342, respectively. Smaller aggregations, possibly breeding, were noted on the Farallon Islands and occasionally small groups were found hauled out at Pt. Reyes and Purissima. The latter animals were no doubt nonbreeding individuals. Earlier observations in 1920 by Evermann (1921), and in 1924 by Evermann and Hanna (1925), showed that in those years the Steller sea lion population was around 2,000 on Año Nuevo Island and no California sea lions were observed there.

The numbers of California sea lions recorded were small and sporadic for the years in which the censuses were made and seemed to lend support to Rowley's (1929) conclusions that Scammon, Elliott, and other early observers confused the two species.

Probably the first real clue to the reason for this seeming confusion was presented by Fry (1939) who made a population study of sea lions for the California Division of Fish and Game in March of that year on some of the Channel Islands. The purpose was to determine the numbers of these animals along the the California coast outside of the breeding season when they are rather widely dispersed and many individuals may be overlooked. Despite this the March count showed the number of California sea lions to be twice that obtained during the census the previous summer. Fry (*op. cit.*) also noted that between the Channel Islands and San Francisco fewer Steller sea lions were seen than during the previous summer. He concluded that the increase in the number of California sea lions was probably the result of an influx of animals from Baja California. This, he stated, "could have been caused by the activities of a dog-food manufacturer who has been using sea lions from Lower California as a meat supply. The creatures may possibly have decided that their old haunts were no longer healthy, but it seems more likely that the migration is a regular annual event."

With regard to the decrease in the number of Steller sea lions in March over the previous summer's population (Fry *op. cit.*) suggests: "If California sea lions show a northward migration, it seems within reason that the Stellers would show a corresponding movement."

Bartholomew and Hubbs (1952) published an account of winter observations on pinnipeds made late in January and early in February, 1950, on Guadalupe, the San Benito, and Cedros islands off the northwest coast of Baja California. The California sea lion populations on both Guadalupe and Cedros islands were small (less than 200 and 340, respectively). On the San Benitos they were extremely high, 9,714 individuals being recorded. Most interesting, however, is

TABLE 3. *Elephant seal population on Año Nuevo Island from March, 1961, to May, 1964.*

<i>Date</i>	<i>Number</i>	<i>Date</i>	<i>Number</i>
1961		1963	
March 11	24	March 3	54
May 7	86	April 13	243
May 25	53	April 19	276
June 27	18	April 21	276
July 13	15	April 22	325
July 28	8	April 25	333
August 11	11	April 29	429
September 7	6	May 8	450
September 23	50	May 23	400
November 19	51	May 27	200
1962		May 29	125
February 24	36	June 4	107
March 24	55	June 6	95
May 15	157	June 11	54
June 5	60	July 12	29
July 3	26	July 23	26
July 16	18	July 30	23
August 4	9	August 19	18
August 18	8	August 23	25
September 1	20	August 30	25
September 21	37	September 6	30
October 24	125	September 13	58
November 26	134	September 27	75
December 20	73	October 12	100
December 29	51	October 25	146
1963		November 13	107
January 9	31	December 28	47
January 19	56	1964	
February 15	76	January 4	45
February 16	70	March 30	112
February 17	71	May 7	483
March 2	52		

the fact that most of these animals were less than 3 years old and the majority were yearlings. These writers state (*op. cit.*): "Of the 9,714 sea lions which we counted on the San Benitos, only 11 were identified as adult males." They concluded, as did Fry (*op. cit.*) that there was a northward postbreeding move-

ment of California sea lions from Baja California. They indicated that this northward migration was essentially confined to adult males. They further state (*op. cit.*) regarding adult male California sea lions as follows: "That they may migrate northward as far as California seems possible. A very high proportion of adult males has been observed in nonbreeding aggregations in that state. Thus on April 22, 1950, Bartholomew estimated that fully 80% of the 956 sea lions on a sandy beach on San Nicolas Island were adult males. The overwintering population of sea lions on a beach in Monterey County south of Point Sur, with numbers estimated by Hubbs as high as 1,800 and by others still higher, consists largely of adult males of this species, with a few Steller sea lions."

Bartholomew and Boolootian (1960) made a study of the summering and wintering populations of pinnipeds on the Channel Islands off southern California so that comparisons could be made with data obtained since 1927 when the first comprehensive census was made by the California Department of Fish and Game. The Steller sea lion population, which reached a peak of about 2,000 animals in that area in 1938, was found to be almost completely replaced by California sea lions by 1958. Only 50 individuals of the former species were recorded the latter year and no bulls were noted in winter. The increase in California sea lions was logarithmic. The nonbreeding population for the Channel Islands was between 9,000 and 10,000 in 1959 and the breeding population that year was more than 13,000. In 1927 the total count for this species for the entire state of California was only 915 in summer. Furthermore, the winter population of California sea lion bulls in 1958 was greater than the summer population. This tended to confirm the theory that there is a northward movement of California sea lion bulls in winter and possibly a southward movement of cows and immatures. The absence of Steller sea lion bulls in winter also indicates the possibility of a northward movement of adult males of this species after the breeding season.

The data from our studies confirm the suggestions made by Fry (1939), Bartholomew and Hubbs (1952), and Bartholomew and Boolootian (1960) concerning a postbreeding northward migration of male California sea lions, and also support the idea that there is a similar northward postbreeding migration on the part of male Steller sea lions in central California. Seasonal movements of Steller sea lions have been noted in British Columbia by Pike and Maxwell (1958) and in Alaska by Kenyon and Rice (1961).

#### AÑO NUEVO ISLAND

The island (fig. 1) is irregular in shape with its main axis in a northwest-southeast direction. It has a land mass of slightly less than 12 acres but an ad-

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FIGURE 1. Aerial view of Año Nuevo Island with Año Nuevo Point in the distance. Photograph by John Gorman, April 7, 1961.









FIGURE 2. Map of Año Nuevo Island. The areas most frequently used by pinnipeds are referred to by number.

ditional 4 acres is provided by adjacent rocks and reefs. These areas were computed at low tide level. The greatest length along the main axis from water line to water line is about 1,300 feet and the greatest width 850 feet. At its narrowest point it is 36 feet. On its seaward side, from the northwestern end to the south end, there are numerous slabs of rock rising out of the water and separated from the main mass of the island. Some of these lie 450 feet from the island. The larger of these rocks, whose exposed surfaces are 300 to 400 feet long, are used extensively by Steller sea lions. For convenience and quick reference, numbers were given to parts of the island and to those rocks that were utilized to a significant extent by pinnipeds (fig. 2).

The island is composed of layered beds of Miocene cherty shale which generally slope down toward the southwest. The most extensive reefs and exposed slabs of shale are on the seaward side. There are two fairly extensive sandy beaches, one on either side of the southeastern half of the island, each over 300 feet in length. The main mass of the island above the beaches and reefs is covered with sand on which a number of kinds of plants grow. The movement of large numbers of sea lions has essentially eliminated vegetation over the southeastern half of the island, but these animals, even when abundant along the shoreline, rarely come onto the top of the northwestern part of the island. Here *Distichlis spicata*, *Lupinus arboreus*, *Eriophyllum staechadifolium*, *Cakile maritima*, *Oenothera cheiranthifolia*, *Amsinckia spectabilis*, *Franseria bipinnatifida*, *Chenopodium californica*, *Spergularia macrotheca*, and *Echeveria farinosa* are among the most common plants found.

For a history of the island and its former utilization as a lighthouse station



FIGURE 3. A Steller sea lion harem in area 7. The bull (slightly right of center) is surrounded by cows with pups in the foreground. Photograph by Robert T. Orr, July 9, 1964.

by the United States Coast Guard, see Orr and Poulter (1962). Although Año Nuevo Island is the most important area for pinnipeds in central California, certain supplemental data obtained from other localities in this region, including the Farallon Islands, Pt. Reyes in Marin County, Seal Rocks off San Francisco, and coastal San Mateo County, are included here.

#### STELLER SEA LION

**AREAS OCCUPIED.** In general the Steller sea lions showed preference for the large, outlying rocks off the northwest end of Año Nuevo Island. Those rocks, designated as 11 and 12, were found to have some of these sea lions on them throughout the year. On only one occasion, December 20, 1962, was rock 11 unoccupied. On this day, however, it was completely awash because of very large swells. Two of the three largest aggregations of breeding sea lions occupied these rocks during the summer months. The other most utilized rock was 10, which, because of its partial division by a surge channel, was designated as 10 E (east) and 10 W (west). Rock 14 was utilized as a hauling-out area through-



FIGURE 4. The total Steller sea lion population on Año Nuevo Island from May 25, 1961, to May 7, 1964.

out most of the year by a small number of Steller sea lions but it was of considerably greater importance to California sea lions and harbor seals. A few harems of Steller sea lions were noted here in the breeding season. Areas 1 and 2 were used to a large extent by bachelors or nonbreeding animals during the breeding season, and to a limited extent by a few females and young during other times of the year when the California sea lion population was low. Area 7 contained an active breeding rookery with 11 harems in the summer of 1961. This is the only breeding group recorded on the main island, either in 1961 or 1962. In 1962 area 7 was occupied by a number of solitary bulls, but no females were present. In 1963 and 1964, however, both area 7 (fig. 3) and area 9 contained breeding groups. Toward the end of the breeding season the smaller rocks around the periphery of reef 7, including 6a, were frequently used as hauling-out areas for cows, pups, and even subadults and occasionally bulls. Solitary bulls were frequently seen on area 8 from late May to early July; and during most of the breeding season some females and pups were found on 9a.

The large sandy beach on the eastern side of the island was not used by Steller sea lions although the sandy beach on the west side (no. 3) was occasionally occupied by bachelors at the height of the breeding season. It appeared that they were forced to occupy it then because the more favorable situations were preempted by the breeding bulls who were rather intolerant of the bachelors from early May until the middle of July.

**BREEDING POPULATION.** Although there was marked seasonal fluctuation in

the total number of Steller sea lions occupying Año Nuevo Island (fig. 4, table 1), as well as changes in the sex and age composition throughout the year, there appears to have been relatively little change in the number of animals breeding here for at least the past 42 years. Evermann (1921), in his report on the Año Nuevo Steller sea lion rookery as of June 27 and 28, 1920, estimated the total population as "between 1,500 and 2,000, with the probability that 2,000 is more nearly correct." His total pup count for the reefs and island was "not more than 100" with another 106 dead or dying pups recorded on the beaches and floating in the water. Counts made on June 22 and 29, 1924, by Evermann and Hanna (1925) again resulted in an estimate of approximately 2,000 animals of all ages. Of this number 954 were adults. Another 150 were estimated to have been overlooked. This would indicate a total adult population of about 1,100 animals. Mention is made of the absence of subadult males and females at this time. Such nonbreeding animals may have been disturbed by human beings, as the island was then being used as a lighthouse station, and nonbreeding animals are easily flushed into the water in contrast to those on breeding rookeries.

These figures are not too different from those obtained by us during the breeding seasons of 1961, 1962, and 1963. On May 25, 1961, a total of 1,500 adults or subadults, including yearlings, was estimated to be present. No separation by age and sex was attempted, but this was just prior to the birth of the first pups. On June 27, 1961, the total population was estimated to be 1,934. On July 3, 1962, the adult and subadult population was estimated to be about 1,500, consisting of approximately 100 bulls, 275 bachelors and subadults, and 1,125 adult females. In addition 750 pups were counted. On July 12, 1963, the Steller sea lion population consisted of about 100 bulls, 266 bachelors and subadults, 1,444 cows, and 585 pups. The pup count was too low because of poor visibility.

The various censuses taken by the California Department of Fish and Game from 1927 to 1961 tend to substantiate the relative uniformity of the breeding population. The summary given by Ripley, Cox, and Baxter (1962) shows a range in numbers counted from 1,200 to 2,500. However, the time, as previously noted, varied from June to July and no effort was made to distinguish species. Furthermore, some counts were made on the ground and others by means of aerial photography.

**BULLS.** Adults bulls spend a relatively short time on the island. They first arrive in the latter part of April, reach maximum numbers by the first of June, begin to leave late in July, and are mostly gone by the middle of August. On April 25, 1963, 10 bulls or large subadult males were observed on the island. Approximately 2 weeks later (May 8) 52 large males were present. Forty-seven were counted on May 7, 1964. Twenty-two of these were bulls and all except one, which was sleeping on beach 3 with a group of California sea lions,



were established on rookery areas. Twelve were associated with cows and yearlings. The remaining 27 males were in bachelor groups. By the last week in May in 1961, 1962, and 1963, approximately 100 harem bulls were present.

By July 28, 1961, the harems had largely broken up and a marked decline in the number of bulls was apparent. In area 7 only two lone bulls were seen on rocks that had contained 10 bulls, 120 cows, and 100 pups 15 days earlier. Aggregations composed of females, pups, subadults, and several bulls were seen on some of the larger islets. On August 4, 1962, and August 11, 1961, only a few bulls were seen in the island area and on August 18, 1962, only one large bull was seen among the 2,427 Steller sea lions counted. The August population consisted almost entirely of adult females, pups, yearlings, and subadults.

**FEMALES.** Evermann and Hanna (1925) reported that the lighthouse keeper on Año Nuevo Island informed them that some sea lions (presumably *Eumetopias jubata*) are present on the island throughout the year. They suggest that "it is possible that the young males and females haul out there after the breeding season is over."

At no time during this study was the island devoid of adult female Steller sea lions, although there were marked seasonal changes in numbers. Maximum numbers were recorded from shortly after the beginning of the breeding period in early June, through September, and minimum numbers in late winter and spring.

On May 15, 1962, the total population for this species consisted of about 200 individuals of which less than 100 were females. On this date some bulls were noted. The arrival of large numbers of females followed the arrivals of the bulls. On June 5, 1962, 558 adult females were counted and the number reached 1,125 on July 3, 1962. The reason for the small number on June 5 of that year is not understood. Some of the females present had young by this date. Furthermore, the presence of harbor seals, elephant seals, and California sea lions indicated that the island had not recently been disturbed by human activities. The previous year, on June 27, the total adult female population was 1,023.

From September until early May the composition of the Steller sea lion herd consists entirely of adult females, young of the year, and a few animals judged to be between 1 and 2 years old. There was a marked decline each year in midwinter in the number of animals present (table 1).

Little is known about the movements of cows or young in winter and spring when the Año Nuevo population shows a marked decline. Some evidence indicates, however, that it may be largely local, perhaps confined to the central California area. During these seasons some females and immatures are usually to be found on Seal Rocks and Pt. Reyes. The following numbers of Steller sea lions, thought to be females and immatures, were observed on Seal Rocks on each of the following dates: January 27, 1962, 10; March 3, 1962, 19;





FIGURE 5. Adult and immature male California sea lions on beach 3. Some may also be seen on the edge of area 19 (upper left) next to the abandoned Coast Guard houses and on area 2 (extreme upper right). A few elephant seals are on the upper beach just below the houses. Photograph by Robert T. Orr, November 13, 1963.

May 26, 1962,  $12 \pm$ ; February 14, 1963, 45; February 16, 1963, 5. A visit to Pt. Reyes on April 15, 1962, showed 10 females and immatures hauled out with a group of 90 California sea lion bulls. We were not able to visit the Farallon Islands where sea lions are present throughout most of the year, but it is probable that a considerable number of Steller females and immatures haul out there.

**BACHELORS.** Nonbreeding males begin to appear on the island at about the same time as the bulls. The first individuals were noted by the latter part of April. On May 8, 1964, 25 bachelors (males not sufficiently old to secure a harem) were present. On June 5, 1962, when 101 bulls were counted, 154 bachelors were recorded. On June 27, 1961, about 200 bachelors and bulls without harems were observed on one beach alone. Others were scattered along the shore, on reefs, and in the water. Two hundred and sixty-four bachelors were counted on July 3, 1962. In 1961, 1962, and 1963, the maximum bachelor and yearling population during the breeding season was between 275 and 300 individuals. By the middle of July there appeared to have been a decline in the number of these nonbreeding sea lions.

Evidence that a northward migration starts about mid-July was obtained



FIGURE 6. California sea lions hauled out on areas 19, 3, and 2 of Año Nuevo Island. Photograph by Robert T. Orr, August 30, 1963.

on July 20, 1961, when one of us (Orr) visited Pt. Reyes, approximately 70 miles northwest of Año Nuevo Island. On this occasion 32 large Steller sea lions, believed to be subadult males or young bulls, were seen hauled out on exposed rocks in the water or on ledges at the base of a cliff. Since Año Nuevo Island is the only known breeding rookery along the central California coast it was suspected that these animals were recent arrivals from there. Nineteen bull California sea lions, also believed to be recent migrants from southern California or northern Baja California, were intermingled with the larger Stellers. A visit to Año Nuevo Island 8 days later revealed a marked decline in both the number of bachelor and bull Steller sea lions and a corresponding increase in male California sea lions. The departure of all of the bachelors was not complete until early September. Not one of this age group was seen on September 7, 1961, while on September 1, 1962, a few remained.

YOUNG. On May 25, 1961, two dead pups were found on one of the sandy beaches but no living young were seen. The pups, which had died very

recently, were thought to have been born prematurely. On June 14, 1961, numerous young were observed. In 1962 no young were present on May 22, but on June 5 there were 18 newborn young. By July 3 the number had increased greatly and 750 were counted. This was considered a very conservative figure since the pups are difficult to count and many are overlooked, especially on the outermost reefs, when they are lying on the far side of adult sea lions. It is probable that the actual figure was closer to 1,000. At the peak of the breeding season in 1961, 1962, and 1963, the total number of adult females was estimated to be approximately 1,100, and probably most of these bore young.

There was a high pup mortality during the first month following birth. Likewise, in midwinter the number of young showed a marked decline. The latter, however, appeared to be correlated with the disappearance of many of the females. It was thought that either many of the young and their mothers left the island or else both spent more time at sea, thus leaving the island relatively depopulated. However, some young were always to be found there throughout the winter and spring months.

A small percentage of yearlings was present during the breeding season and some were observed until the following January at which time they were 19 or 20 months of age. Mathisen, Baade, and Lopp (1962) estimated that yearlings constituted about 15 per cent of the Steller sea lion population on Chernabura Island, Alaska, in the summer. This is much higher than we observed on Año Nuevo Island.

#### CALIFORNIA SEA LION

**AREAS OCCUPIED.** Members of this species, unlike the larger Steller sea lions, show preference for sandy beaches or inner reefs and rocks. The greatest numbers of California sea lions were found on the southern part of Año Nuevo Island because of the presence there of these habitats. The area most frequently used for hauling out throughout much of the year was the sandy, seaward beach designated as 3 (fig. 5). This beach is approximately 350 feet long and slopes gently back 50 to 75 feet to the base of the bluff marking the edge of the main body of the island. The few individuals present in midsummer could be found here. This was also true during the population low of late winter and early spring. On September 27, 1963, when the population was high, 2,125 California sea lions and 75 elephant seals were counted on this beach. The greatest number seen here was on May 7, 1964, when 2,700 California sea lions and 483 elephant seals were recorded. Since the area of this beach is only 0.56 acre, an average of about 7 square feet was available for each of the 3,183 animals.

During the population peak in late summer and early autumn area 19, comprising the top of the south end of the island, was frequently utilized as a resting area by the majority of the California sea lions present (fig. 6). For

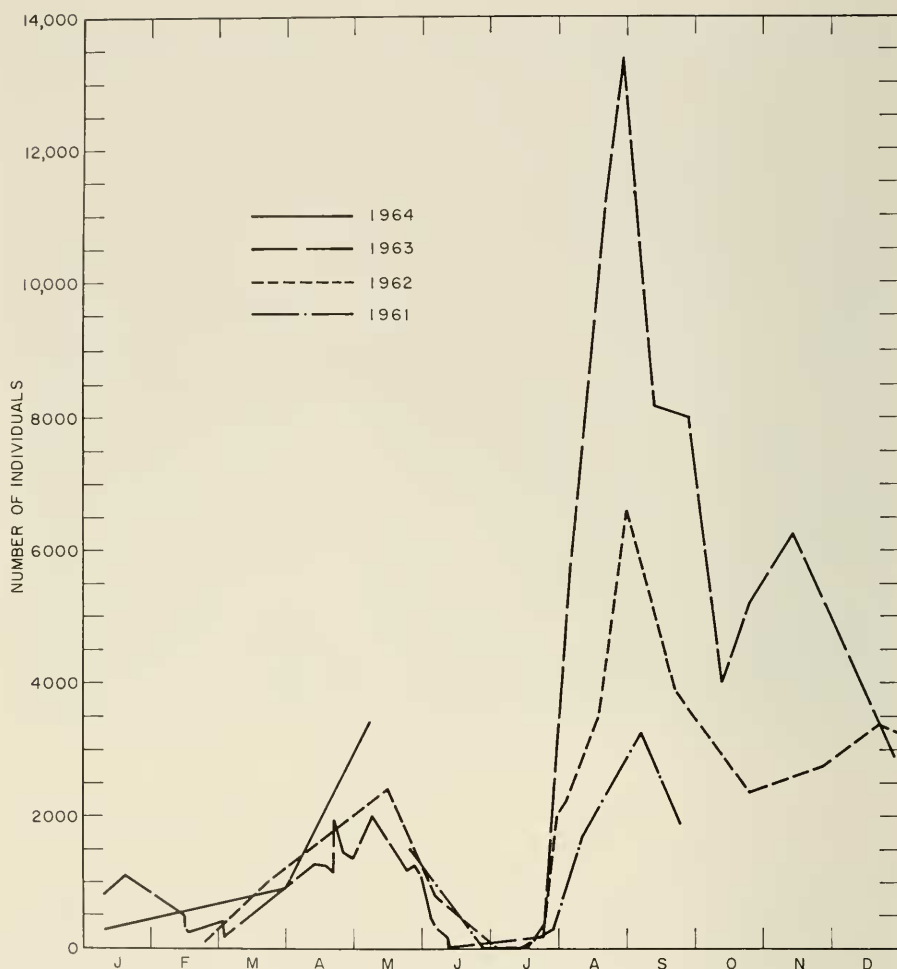


FIGURE 7. Seasonal fluctuation and annual increase in the California sea lion population on Año Nuevo Island from May 25, 1961 to May 7, 1964.

example, on August 30, 1963, about 9,000 individuals were observed here. The total count for the island on this day was slightly more than 13,000. On September 13, 1963, when the total count for this species for the island was approximately 8,000, about 5,000 were on area 19. At other times of the year area 19 was rarely used. Beach 17 on the leeward side of the island was another hauling-out area found to be important when the population was high or when the animals had been disturbed elsewhere. It is 0.95 acre in extent and, unlike the seaward beaches, consists of coarse gravel, shells, and rocks in addition to sand.



In late August and September 1963, over 1,000 individuals were recorded here on several occasions.

Areas 1, 2, 3a, 6a, 9, 9a, 14, 15, 16, and 18 were also frequently used by California sea lions. Rocks designated as 4, 5, and 6 were of little significance because of their small size. Less frequently used as hauling-out areas by members of this species were areas 7, 10E, 10W, 11, and 12. These provided the major breeding areas for Steller sea lions. Area 11 was also occupied throughout the year by Steller sea lions. Only on rare occasions did California sea lions haul out here. Their essential absence from this rock, however, was attributed to its exposed seaward position rather than to the presence of the larger Steller sea lions (Orr, 1965).

SEASONAL AND ANNUAL CHANGES IN NUMBERS. As noted previously, there is little information available on the presence of this species in central California. Several aerial photographs of Año Nuevo Island taken in 1953 and made available to us by the United States Coast Guard reveal the presence of about 1,000 California sea lions on beach 3. From our present knowledge of the habits of these animals we judge that the pictures were taken sometime during the winter season.

Two of the most interesting discoveries made during this study were the marked seasonal changes that occurred in the numbers of California sea lions on Año Nuevo Island and the great increase in the population each successive year. There were two population peaks during each year, one just prior to the middle of May and the other about the first of September (fig. 7, table 2). The September peak, however, was by far the higher. Both population highs were of rather brief duration. Following the spring peak there was a steady decline in numbers until the latter part of June when practically no California sea lions were present. They reappeared in the latter part of July and within 5 or 6 weeks reached maximum numbers. By October 1 the population declined to about one-half that present in early September and then gradually leveled off until the first of the year at which time a second low of 1,000 or less was found. Around April 1 there was an increase in numbers again which culminated in the spring peak. The population during the September peak in 1962 was essentially twice that of 1961, and that of September 1963 was twice that of 1962 (fig. 7, table 2). This is even greater than the rate of increase recorded from the Channel Islands by Bartholomew and Boolootian (1960).

The absence of California sea lions throughout most of June and July in Central California was correlated with the breeding season for this species and we presume these animals migrated south to rookeries on the islands off southern California and the west coast of Baja California. A possible explanation to account for the fall and spring peaks at Año Nuevo Island is that many sea lions migrating to and from nonbreeding areas north of central California rest at the island for a while en route. This might be an especially important





FIGURE 8. Immature elephant seals on beach 3. Male California sea lions may be seen in the distance near the water's edge. Photograph by Richard Jennings, early May, 1963.

resting place in late August and September after the rigors of the reproductive season farther south.

**SEX AND AGE COMPOSITION.** In no instance during the 3 years of this study was the total California sea lion population found to consist of less than 80 per cent adult males. The others were immatures ranging from subadults down to individuals that were thought to be yearlings. Every individual in this immature class whose sex could be determined proved to be a male. This was also true of all young California sea lions found dead on the island.

These observations substantiate the suggestion made by Bartholomew and Hubbs (1952) that adult male California sea lions move north to California after the breeding season. These authors found males of this species essentially absent in winter from the islands where they breed along the west coast of Baja California. They also comment on the fact that on April 22, 1950, fully 80 per cent of the 956 California sea lions on San Nicolas Island off the coast of southern California were adult males.

#### NORTHERN ELEPHANT SEAL

**AREAS OCCUPIED.** The history of the development of the elephant seal colony on Año Nuevo Island has already been described (Radford, Orr, and Hubbs, 1964). Elephant seals were most often seen on beach 3 where they



FIGURE 9. A young bull elephant seal in process of molt in summer on Año Nuevo Island. Photograph by Robert T. Orr, July 9, 1964.

tended to stay on the upper dry sandy parts. This is in contrast to California sea lions which were usually found closer to the water's edge (fig. 8). This habitat preference by members of this species is thought to be associated with their habit of throwing dry sand over the body with the front flippers.

Beach 3a was also used occasionally by a few immature animals. Rarely single individuals were seen on top of the island in area 19. Small numbers of immatures were sometimes noted on beach 17 in spring and fall. This area, however, was regularly used by solitary bulls during the breeding season. These large males might also be found anywhere about the periphery of the island from late December until early March.

All breeding activity was confined to beaches 3 and 17. Cows and pups were not noted elsewhere. Although most of the young were observed on beach 3, three were born on beach 17 in January, 1963, and 16 during the 1964 breeding season.

**MALES.** Large males, ranging in age from old bulls to subadults or bachelors, were regularly observed from December until March and again during July and August. A few large subadults were seen at other times. Each



FIGURE 10. An elephant seal bull with a harem of cows and pups on beach 3. Photograph by Richard Jennings in late January, 1963.

year the population appeared to increase over that of the preceding year. Four large males were recorded on July 28, 1961, 6 on February 24, 1962, 8 on July 16, 1962, 23 on December 29, 1962, 22 on July 23, 1963, and 20 on December 28, 1963. Even though this paper relates primarily to observations made up to May 7, 1964, 30 big males were counted on July 9, 1964. The large males all appeared to undergo a molt in summer (fig. 9).

**FEMALES.** Adult females are present during the reproductive season which is from the latter part of December until March (fig. 10). Not one was observed during July and August. Their presence in spring and fall was questionable and difficult to ascertain because of the large number of immatures of both sexes that were present then.

**PUPS.** The young are born in January and February. Each winter during this study the number of births increased. Twenty-three were recorded in 1962, 32 in 1963, and 60 in 1964. These young began leaving by the end of May and by midsummer were mostly gone, although a few were noted later. Since metal flipper bands were attached to 12 of the 23 pups born in the winter of 1962 and to all but one or two in 1963 and 1964, it was easy to determine the presence or absence of the young subsequently. Some information was obtained regarding the movements of these animals. One male, tagged as a pup on Año Nuevo Island on March 28, 1962, was observed by Dr. David Regnery and

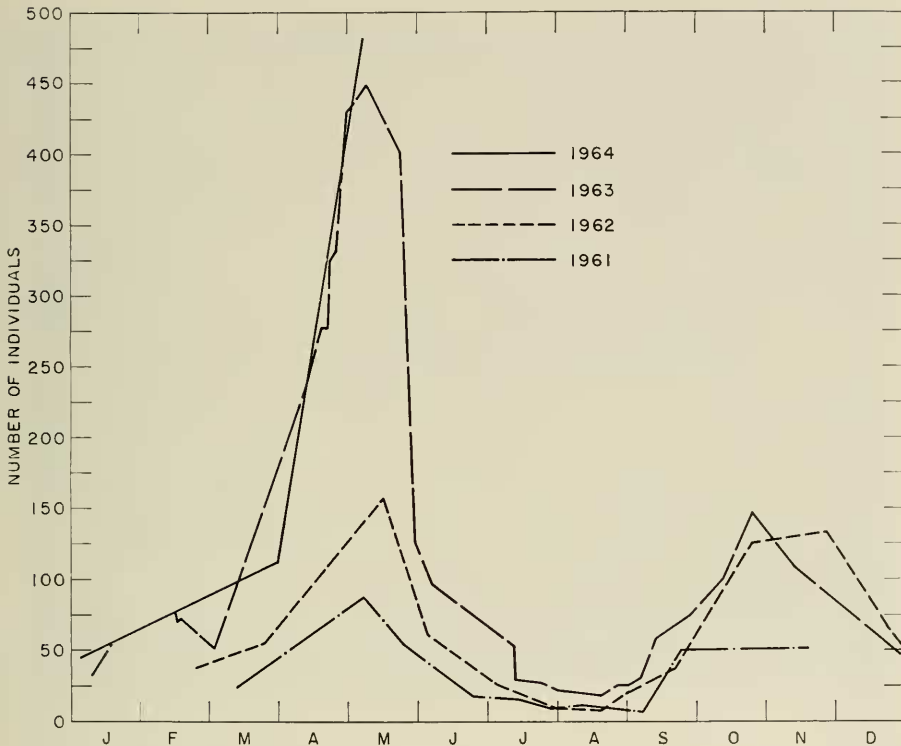


FIGURE 11. Seasonal fluctuation and the annual increase in the elephant seal population on Año Nuevo Island from May 7, 1961 to May 7, 1964.

Theodore C. Pinney on South Farallon Island on September 20, 21, and 22, 1962. In late May, 1964, three of five elephant seals seen by the same observers on South Farallon bore Año Nuevo Island tags. The Farallon Islands are approximately 55 miles northwest of Año Nuevo Island. A male elephant seal that had been tagged as a pup on Año Nuevo Island on February 17, 1962, was found dying on a beach  $5\frac{1}{2}$  miles south of Cape Sebastian, Oregon, by Dan Snook on May 30, 1964, and reported to the Oregon Fish and Game Commission. The distance between these two localities is nearly 400 miles.

**IMMATURES.** The majority of elephant seals on Año Nuevo Island come under this category, here used to include animals ranging from about 6 months of age up to, but not including, subadults. Males classified as subadult were those with a fairly well developed, yet not markedly, pendulous proboscis and which lacked the gray and pink coloration on the thickened epidermal shield of the chest and neck. With the females age grouping was more difficult so relative size alone was relied upon.



Because the young are born in January and February, the influx of immature elephant seals which began in early September and reached a peak in October (table 3) was composed of animals over 6 months of age. No adults or subadults were noted until late in November when the immature population began to decline. A few immatures were still present in January, but none was recorded in February. In March immatures again appeared on the island. This influx continued through April, with the greatest number of individuals for the year being recorded about the beginning of the second week of May (fig. 11). Maximum numbers recorded for 4 years are as follows: 86 on May 7, 1961 (Radford, Orr, and Hubbs, 1964, table 1), 157 in 1962, 450 on May 8, 1963, and 483 on May 7, 1964. On only one of these dates were any individuals other than immatures and young of the year noted. This was on May 15, 1962, when two subadult males were seen. Bartholomew and Hubbs (1960) noted a complete absence of adults in April on Guadalupe Island.

After the middle of May the number of immatures declined, and by July they were mostly replaced by large males. The number of males exceeded the number of females during the spring peak but in late September and October the sexes were present in about equal numbers.

#### HARBOR SEAL

**AREAS OCCUPIED.** The harbor seal, unlike the Steller sea lion, the California sea lion, and the elephant seal, is a shoreline, bay, and estuarine species. In the Año Nuevo area it is not limited to the island but is also found along the adjacent rocky mainland. There appeared to be a movement of individuals between these two areas which are separated by only one-half mile of shallow water.

On Año Nuevo Island harbor seals were observed in the vicinity of the northern and northeastern parts. During low tide area 13 was a favorite resting place. Here they were scattered on rocks that were underwater at high tide and with the incoming tide they floated or swam off. Some would remain in the protected cove formed by rocks 11, 12, 13, 14, and 15, while others frequently moved onto a ledge on the south end of 14 (fig. 12). A number of individuals could usually be observed in the water east of both 14 and the northern part of 17 during high tide.

On the mainland the principal hauling-out areas at low tide were offshore rocks about one-quarter of a mile north of Año Nuevo Point and a large offshore rock about 300 yards east of the point in Año Nuevo Bay. At high tide most of the seals appeared to stay in the water between the point and the island or in the Año Nuevo Bay just east of the point.

**POPULATION.** The maximum number of harbor seals in the area extending from the northwestern part of Año Nuevo Bay to the end of the reefs about 1



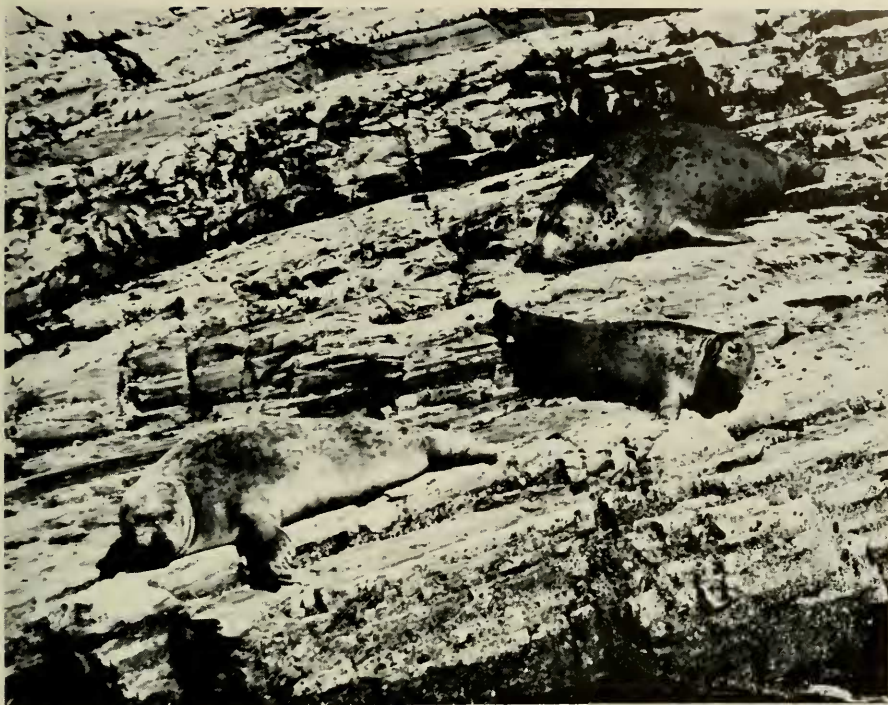


FIGURE 12. Three harbor seals on a ledge near the water's edge on reef 14. Photograph by Robert T. Orr, July 23, 1963.

mile north of Año Nuevo Point and out to the island itself was estimated to be about 100. The greatest number counted at low tide was 86 on July 23, 1963. Not all potential hauling-out areas were examined at this time and some individuals may have been overlooked in the water.

There was no indication, locally, of any migratory movement on the part of harbor seals; consequently the population showed only minor fluctuations throughout the year. Since the young are born in this region from late March through May, somewhat greater numbers were noted in June and July.

#### NORTHERN FUR SEAL

On July 27, 1962, James H. Miller observed a fur seal periodically occupying a rock in area 18. The following day one of us (Poulter) photographed it with a 24-inch telephoto lens. Pictures were sent to Dr. Victor B. Scheffer and Dr. Carl L. Hubbs, both of whom are familiar with fur seals. Each wrote that without doubt it was a northern fur seal (*Callorhinus ursinus*); Dr. Scheffer further concluded from the appearance of the animal that it was a male "at least five years old and probably much older."

Through the courtesy of Mr. Raymond Bandar we also examined a skull from a northern fur seal that washed ashore on Waddell Beach in the spring of 1959. This locality is about 3 miles southeast of Año Nuevo Island.

On March 30, 1964, we found the remains of a newborn northern fur seal on beach 17. The skin, vertebral column, and shoulder girdles were all that remained, but this was sufficient for identification. It was suspected that gulls had attacked the carcass. We do not know whether this seasonally early birth occurred on this beach or at sea.

Northern fur seals regularly winter in small numbers off the California coast but these are mostly females (Taylor, Fujinaga, and Wilkie, 1955). Since many of the females are pregnant, an occasional birth prior to the northward migration to the Pribilof Island rookeries does not seem too unusual. Much more surprising is the presence of the adult male in the midsummer of 1962. Males recorded along the California coast have been young and were not found in midsummer.

#### ACKNOWLEDGMENTS

Many persons visited Año Nuevo Island with one or both of us during the course of this project. To these persons we wish to express our sincere thanks for numerous valuable suggestions. We are indebted to the California Division of Beaches and Parks for permission to make these studies on property under its administration. Personnel of that Division in Sacramento, as well as in the Half Moon Bay office, were extremely generous in providing maps, photographs, and other valuable data bearing on the region; frequently one or more staff members accompanied us on our visits.

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